

Growth of GaAs Epitaxial Layers on Si Substrate by Using a Novel GeSi Buffer Layer

ABSTRACT OF THE INVENTION

This invention provides a process for growing Ge epitaxial layers on Si substrate by using ultra-high vacuum chemical vapor deposition (UHVCVD), and subsequently growing a GaAs layer on Ge film of the surface of said Ge epitaxial layers by using metal organic chemical vapor deposition (MOCVD).

The process comprises steps of, firstly, pre-cleaning a silicon wafer in a standard cleaning procedure, dipping it with HF solution and prebaking to remove its native oxide layer. Then, growing a high Ge-composition epitaxial layer, such as $\text{Si}_{0.1}\text{Ge}_{0.9}$ in a thickness of $0.8\ \mu\text{m}$ on said Si substrate by using ultra-high vacuum chemical vapor deposition under certain conditions. Thus, many dislocations are generated and located near the interface and in the low of part of $\text{Si}_{0.1}\text{Ge}_{0.9}$ due to the large mismatch between this layer and Si substrate.

Furthermore, a subsequent $0.8\ \mu\text{m}$ $\text{Si}_{0.05}\text{Ge}_{0.95}$ layer, and/or optionally a further $0.8\ \mu\text{m}$ $\text{Si}_{0.02}\text{Ge}_{0.98}$ layer, are grown. They form strained interfaces of said layers can bend and terminate the propagated upward dislocation very effectively. Therefore, a film of pure Ge is grown on the surface of said epitaxial layers.

Finally, a GaAs epitaxial layer is grown on said Ge film by using MOCVD.